

CLAIMS

What is claimed is:

1. A satellite communication system comprised of a plurality of satellites and a plurality of gateways, said satellite communication system being bidirectionally coupled to a terrestrial communication system through at least said plurality of gateways, said satellite communication system and said terrestrial communications system comprising together a data communication network having a plurality of nodes including source nodes, destination nodes and intermediate nodes, wherein multiple copies of a packet coexist within the data communications network and are routed, using at least in part satellite-resident routers and gateway-resident routers, over a plurality of different paths between a particular source node and a particular destination node, and wherein at least one duplicate copy of a given packet is not used during the execution of a packet reordering procedure in the destination node, or at an intermediate node.

2. A system and network as in claim 1, wherein certain of said paths are carried over satellite-to-satellite cross-links.

3. A system and network as in claim 1, wherein certain of said paths are carried over satellite-to-gateway uplinks and downlinks.

4. A system and network as in claim 1, wherein at least one of said paths is carried over a satellite-to-user terminal uplink and downlink.

5. A system and network as in claim 1, wherein said packets are TCP/IP packets (or packets with equivalent

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protocol) containing information for enabling said duplicate packets to be ignored.

6. A system and network as in claim 1, wherein said plurality of gateways couple said satellite communication system to said terrestrial communication system at a plurality of points, including at least at one of regional networks, national networks, commercial networks, Internet Service Providers (ISPs), or directly to a backbone network.

7. A system and network as in claim 1, wherein said plurality of satellites comprise a constellation of non-geosynchronous orbit satellites.

8. A system and network as in claim 1, wherein said plurality of satellites comprise a constellation of low earth orbit satellites.

9. A system and network as in claim 1, wherein said plurality of satellites comprise a constellation of medium earth orbit satellites.

10. A system and network as in claim 1, wherein said packets are TCP/IP or equivalent packets.

11. A system and network as in claim 1, wherein at least some of said packets comprise voice data.

12. A system and network as in claim 11, wherein said system routes said packets comprised of voice data over semi-permanent paths that are established during the duration of a call.

13. A system and network as in claim 11, wherein said at least some of said packets that comprise voice data

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comprise vocoded voice data that is generated external to a user terminal and that is input to the user terminal for transmission to at least one satellite.

14. A system and network as in claim 11, wherein said at least some of said packets that comprise voice data comprise vocoded voice data that is generated internal to a user terminal for transmission to at least one satellite.

15. A system and network as in claim 1, wherein said duplicate packets are transmitted from a plurality of satellite-resident routers to a single gateway-resident router, and are injected into the Internet by the single gateway-resident router.

16. A system and network as in claim 1, wherein said duplicate packets are transmitted from a plurality of satellite-resident routers to a plurality of gateway-resident routers, and are injected into the Internet by each of the plurality of gateway-resident routers.

✓ 17. A satellite communication system comprised of a plurality of satellites and a plurality of gateways, said satellite communication system being bidirectionally coupled to a terrestrial communication system through at least said plurality of gateways, said satellite communication system and said terrestrial communications system comprising together a data communication network having a plurality of nodes including source nodes, destination nodes and intermediate nodes, wherein multiple copies of a packet are selectively generated within the data communications network, and wherein the multiple copies of the packet are routed, using at least in part satellite-resident routers and gateway-resident routers, over a plurality of different paths between a particular source node and a particular destination node, and wherein

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at least one of the multiple copies of a packet is not used during the execution of a packet reordering procedure in the destination node, or at an intermediate node.

18. A system and network as in claim 17, wherein the multiple copies of packet are selectively generated based on at least one of a plurality of criteria.

19. A system and network as in claim 18, wherein one of the plurality of criteria is a measure of the quality of the transmission medium.

20. A system and network as in claim 18, wherein one of the plurality of criteria is whether the packet was previously duplicated by a previous node.

21. A system and network as in claim 18, wherein one of the plurality of criteria is a number of remaining hops from the current node to the destination node.

22. A system and network as in claim 18, wherein one of the plurality of criteria is the current available bandwidth.

23. A system and network as in claim 18, wherein one of the plurality of criteria is based on a user service agreement.

24. A system and network as in claim 18, wherein one of the plurality of criteria is based on a direction of transmission, from source to destination or from destination to source.

25. A system and network as in claim 18, wherein one of the plurality of criteria is based on whether multicasting is desired.

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26. A system and network as in claim 17, wherein certain of said paths are carried over satellite-to-gateway uplinks and downlinks, and certain other paths are carried over satellite-to-satellite cross-links.

27. A system and network as in claim 17, wherein at least one of said paths is carried over a satellite-to-user terminal uplink and downlink.

28. A system and network as in claim 17, wherein said packets are TCP/IP packets (or packets with equivalent protocol) containing information for enabling said duplicate packets to be ignored.

29. A system and network as in claim 17, wherein said plurality of gateways couple said satellite communication system to said terrestrial communication system at a plurality of points, including at least at one of regional networks, national networks, commercial networks, Internet Service Providers (ISPs), or directly to a backbone network.

30. A system and network as in claim 17, wherein said plurality of satellites comprise a constellation of non-geosynchronous orbit satellites.

31. A system and network as in claim 17, wherein said plurality of satellites comprise a constellation of low earth orbit satellites.

32. A system and network as in claim 17, wherein said plurality of satellites comprise a constellation of medium earth orbit satellites.

33. A system and network as in claim 17, wherein individual ones of said packets conform to TCP/IP or an

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equivalent protocol.

34. A system and network as in claim 17, wherein at least some of said packets comprise voice data.

35. A system and network as in claim 34, wherein said system routes said packets comprised of voice data over semi-permanent paths that are established during the duration of a call.

36. A system and network as in claim 34, wherein said at least some of said packets that comprise voice data comprise encrypted voice data.

37. A system and network as in claim 17, wherein said multiple copies of a packet are transmitted from a plurality of satellite-resident routers to a single gateway-resident router, and are injected into the Internet by the single gateway-resident router.

38. A system and network as in claim 17, wherein said multiple copies of a packet are transmitted from a plurality of satellite-resident routers to a plurality of gateway-resident routers, and are injected into the Internet by each of the plurality of gateway-resident routers.

✓ 39. A method for packet data transmission through a data communications system comprising satellite routers and terrestrial routers, comprising steps of:

originating a stream of packets at a source node;

selectively duplicating individual ones of the stream of packets and operating said satellite routers to route duplicate packets over different paths,

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including wireless paths through a medium subject to transmission impairments; and

reconstructing the stream of packets from received packets while ignoring an arrival of an already received and valid packet.

40. A method as in claim 39, wherein the step of selectively duplicating is performed in at least one satellite router in response to at least one criterion.

41. A method as in claim 40, wherein said at least one criterion is one of a measure of the quality of the medium; whether the packet was previously duplicated; a number of remaining hops from the satellite router to a destination node; a current available bandwidth; a user service agreement; a direction of transmission, from source to destination or from destination to source; and whether multicasting is desired.

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